SB761
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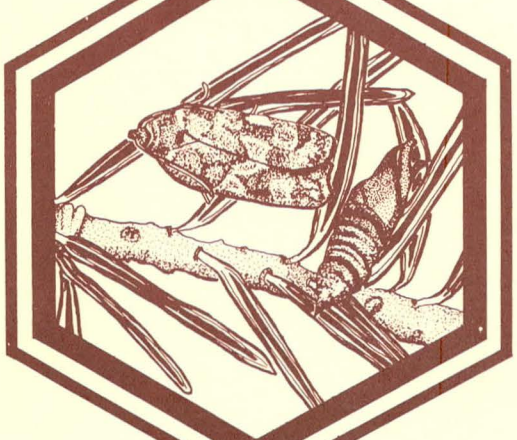

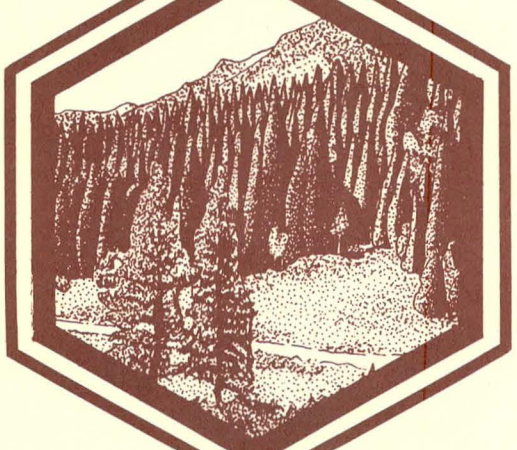

REPORT No. 77-2

ASCAS

DATA MANAGEMENT SYSTEM FOR ASSESSMENT OF AERIAL SPRAY DEPOSITS

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Methods Application Group
Forest Insect and Disease Management
Forest Service, USDA
Davis, California

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Report No. 77-2

5200
July 1977

ASCAS -- DATA MANAGEMENT SYSTEM FOR ASSESSMENT OF AERIAL SPRAY DEPOSITS

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ABSTRACT

A computer system is available to summarize the deposition of aerially applied insecticides collected on various collection media. The system is operable on the Fort Collins Computer Center and the University of California Davis Computer Center. The parameter driven system allows the users to summarize at various levels. Outputs from the system include droplet diameters of the spray cloud in terms of mass media diameter and deposition density in terms of droplets per square centimeter and ounces per acre.

INTRODUCTION

Assessment of deposits achieved by application of insecticides has been increasingly important in the USDA Forest Service in recent years. It has found application in monitoring insecticide sprays from aircraft both for effectiveness in reaching the intended target and for drift to non-target areas. Studies of the relationship between insect mortality and spray deposit are useful in evaluation of aircraft and pesticide performance, and in selection of spray equipment and determination of optimum application rates. Spray deposit assessment also has been used in connection with herbicide sprays. Increasing environmental concerns will probably result in greater demand for spray deposit assessment.

Because of the increased emphasis upon spray accountancy by the USFS, there was need for a procedure for evaluating spray deposit cards which was rapid and accurate, and would provide standard

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results. The procedure for spray deposit assessment consists of four steps: (1) collection of spray on deposit cards in the project area; (2) counting and sizing stains or spots on a rectangular section of the card (done by using a plastic overlay with a grid and a microscope or hand lens with an internal scale or automatically by an instrument known as the Quantimet Image Analyzer which is produced by Cambridge Instrument Company); (3) analysis of the spot count data with the ASCAS Program; and (4) evaluation of spray deposit results through comparison of spray deposit versus insect mortality, tree defoliation, and canopy penetration, spray drift, meteorology, etc.

The Automatic Spot Counting and Sizing (ASCAS) Program was originally developed by the U.S. Army Dugway Proving Ground (DPG), Utah. A version of this program was provided by DPG and modified by the Methods Application Group for FI&DM.

This program analyzes the spot count data obtained from spray deposit cards. It computes the various drop diameters of the spray cloud: mass median diameter (also known as MMD and VMD), mass mean diameter, number median diameter, and number mean diameter. It also computes deposition density in terms of milligrams per square meter, droplets per square centimeter, fluid ounces per acre and U.S. gallons per acre. The spectrum of the spray cloud is described by giving both the counts and the mass in each of 16 size categories. Fewer size categories can be used if desired. To increase flexibility and usefulness, several analysis options have been built into the program. There are three different functional forms of the spread factor equation. There is an option for writing output to printer or disk. Each data card contains a unique identifier for sorting. Intermediate summaries of results can be obtained when certain changes occur in the identifier. Additional summaries can be obtained by reordering the identifiers prior to sorting. Lastly, there are four options for treating cards with duplicate identifiers.

The program is established at the computer center of the University of California at Davis, California, and the Fort Collins Computer Center in Colorado. The program can be run by anyone with access to either of these computer centers. Purpose of this publication is to provide user documentation for executing this system at either of these computer centers.

INPUT (DATA PREPARATION)

The data input comes from hand counted spray cards or from machine counted cards. Both systems record the number of spots by established stain size categories from a specific location and size on the spray cards.

I. Data Cards

Data cards contain an identification field and droplet counts by size categories in increasing order. The limit of data is 900 spray cards for one run. The data from one spray card can be included on one punched card under the standard format (A6, A4, 2X, 16 F 4.0), or on one card with a different format, or on more than one punched card. If the format is not standard, the user must determine the format and include it with the parameter cards. All 16 size categories do not have to be used, but must be included in the format.

II. Parameter Cards

The user must provide the parameter cards necessary for running the system. The ASCAS Parameter Worksheet (Figure 1) has been developed for user ease. An example of a completed form has been provided (Figure 2).

A. Card (1) Title:

User must specify the title of 80 characters or less for each data set. This title is printed at the top of each page of the printed output.

B. Card (2) Options:

The options are given below in the order they occur on the card. The format is (10I2).

1. Form of the spread factor (IFN)

IFN = 01 if Drop = A + B(Stain) + C(Stain)^2

02 if Stain - A + B(Drop) + C(Drop)^2

03 if Drop = A(Stain)^B

The units for Drop and Stain are micrometers. If option 02 is used, the equation must be a quadratic, i.e., C must be non-zero. If the spread factor is of the form

Stain = A + B(Drop), the user must convert the relationship to:

Drop = $\frac{-A}{B} + \frac{1}{B}$ (stain), where

$A' = (\frac{-A}{B})$, $B' = (\frac{1}{B})$, and $C = 0$.

IFN would be 01.

2. Options for printing input and output data (IPRINT)

IPRINT = 00 Print spot count data and output.

01 Print output only.

02 Print spot counting data and output and write output to disk.

03 Print output only and write output to disk.

3. Options for level of intermediate summary (ISUMRY)

ISUMRY = 00 No intermediate summary.

0N Where N is an integer satisfying $1 \leq N \leq 5$.

This will produce a statistical summary for all cards which have the same first N identifier fields. This statistical summary has the same form as the one produced for all cards at the end of the run.

If the data is not sorted, only cards with the same first N identifier which are in sequence will be recognized.

4. Options for duplicate data (IDUP)

IDUP = 00 No modification of data.

01 Keep last card only from sequence of cards with duplicate identifiers.

02 Average all cards with duplicate identifiers.

03 Add all cards with duplicate identifiers.

If data is not sorted, only cards with duplicate identifiers which are in sequence will be recognized.

5. Option for sorting data (ISØRT)

ISØRT = 00 No sort

= 01 Sort cards using identifier

6. Option for reordering the identification fields to other positions. [IØRDER(I)]

IØRDER(I) = 00 No reporting is done

ON Where N is an integer satisfying $1 \leq N \leq 5$. The identifier field in position N is moved to position I prior to sorting.

Example: Suppose there are three levels of identification, block, cluster and tree in position 1, 2, 3. We could reorder the identification to block, tree and cluster by putting in 010302 for the values of IØRDER(I). This then, if ISUMRY = 02, would produce and intermediate summary for all tree 1's, tree 2's, and tree 3's separately.

C. Card (3) Spray Variables

The variables are given below in order in which they occur on the card. The card format is (6F10.0).

Internal Variable Name	Descriptions
DENS	Density of material producing spots in grams/milliliter. For all practical purposes, this is the specific gravity.
FOPT	Factor by which the linear dimension of the spray card image is reduced on film. This has the value 1.0 when no photo reduction is used.
Ƶ	Area that is scanned by spot counting machine. Units are square centimeters.

AA BB CC	These three variables are the coefficients in the spread factor equation.

Decimals need to be punched in the card; the last character of each parameter must end in Column 10, 20, 30, 40, 50 and 60 respectively.

D. Card (4) Size Category

The user must determine the upper limits of the 16 size categories and record them on Card 4 in increasing order. Units are micrometers. The card format is (16F5.0).

E. Card (5) Format Of Data Cards

This card is not required if the spot count data cards have the format (A6, A4, 2X, 16F4.0) which is the default format in program ASCAS. If a format is specified by this card, it must satisfy certain restrictions, particularly in regard to the format of the identifiers.

III. Specific Guidelines For User Supplied Format Cards

The data card contains an identifier and spot counts for each of the 16 size categories in increasing order. The format is (A6, A4, 2X, 16F4.0). No card is required if the data has this format. If it is necessary to specify a different format it must begin with the left parenthesis (in Column 1. The format for the spot count can be any F or E format. See a FORTRAN reference manual for an explanation of format specifications. There are restrictions on the identifier and its format which are described below.

The identifier on the card consists of one to five fields and each field consists of one to five alphabetic or numeric characters. The fields are separated by one or more specific characters which include:

+	=	?	/	&	- dash
(	:	>	@	%	' apostrophe
(		<	#	$	blank
.	*		;		, comma

The identifier on the card consists of a maximum of 12 characters counting both the fields and their separators.

Spray Deposit Assessment -- ASCAS Parameter Worksheet

Project _____ Region/Area _____ Year _____

Location of cards -- under trees _____ Open _____ Other _____

Block (name/number) _____ Number of spray cards _____

1. Card 1 - Title (up to 80 alphanumeric characters)

```
      5         10        15        20        25        30        35        40
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      45        50        55        60        65        70        75        80
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

2. Card 2 - Option

   a. Form of spread factor (IFN) 01, 02, 03
   b. Options for printing input and output data (INPRINT) 00, 01, 02, 03
   c. Options for intermediate summaries (ISUMRY) 00, 01, 02, 03, 04, 05
   d. Options for duplicate data (IDUP) 00, 01, 02, 03
   e. Options for sorting data (ISORT) 00, 01
   f. Options for reordering identification fields (IORDER) - See Manual

```
  2   4   6   8   10  12  14  16  18  20
_ _|_ _|_ _|_ _|_ _|_ _|_ _|_ _|_ _|_ _|
```

3. Card 3 - Spray variables

   a. Density of materials (DENS) _____

   b. Photo reduction factor (FOPT) _____

   c. Area scanned by machine (Z) _____

   d. Spread factor (specify equation) _____

      AA = _____ BB = _____ CC = _____

```
          10                  20                  30
- - - - - - - - - -|- - - - - - - - - -|- - - - - - - - - -|
          40                  50                  60
- - - - - - - - - -|- - - - - - - - - -|- - - - - - - - - -|
```

4. Card 4 - Upper limits for categories (micrometers) - See Manual

```
      5         10        15        20        25        30        35        40
_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|
      45        50        55        60        65        70        75        80
_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|_ _ _ _|
```

5. Card 5 - Optional format card - See Manual

(_

Prepared by _____ Date _____

Figure 1 - ASCAS Parameter Worksheet

Spray Deposit Assessment -- ASCAS Parameter Worksheet

Project SBW PILOT - ORTHENE Region/Area 4 Year 77

Location of cards -- under trees X Open _____ Other _____

Block (name/number) FOUR MILE CR Number of spray cards 300

1. Card 1 - Title (up to 80 alphanumeric characters)

```
SBW_PILOT_PROJECT_ORTHENE_R4_1977_____
```

2. Card 2 - Option

a. Form of spread factor (IFN) (01) 02, 03
b. Options for printing input and output data (INPRINT) (00) 01, 02, 03
c. Options for intermediate summaries (ISUMRY) 00, 01, (02) 03, 04, 05
d. Options for duplicate data (IDUP) (00) 01, 02, 03
e. Options for sorting data (ISORT) 00, (01)
f. Options for reordering identification fields (IORDER) - See Manual

```
01|0002|0001|01|02|03|__|__|
```

3. Card 3 - Spray variables

a. Density of materials (DENS) .915 gm./ml.

b. Photo reduction factor (FOPT) 1.0

c. Area scanned by machine (Z) 8.840

d. Spread factor (specify equation) $Drop = 6.508 + .476(STAIN) + .0058(STAIN)^2$

AA = 6.508 BB = .476 CC = .0058

```
_____.915|_____1.0_____8.840
_____6.508|_____.476_____.0058|
```

4. Card 4 - Upper limits for categories (micrometers) - See Manual

```
___95|__202|__301|__400|__498|__601|__704|__795|
__901|__996|_1103|_1201|_1300|_1574|_1776|_2000
```

5. Card 5 - Optional format card - See Manual

```
(A6,A2,4X,16F4.0)_____
```

Prepared by MM Date JULY 1977

Figure 2 - ASCAS Parameter Worksheet

The identifier is read into the computer as 2 words using A formats. Each word consists of 6 characters, therefore, the identifier in the computer has exactly 12 characters. The Am, for $1 \leq m \leq 6$, format specification causes m characters on a card to be placed in the computer in the left side of a 6 character word with the remainder of the word filled with blanks. The format for the identifier should be selected so that blanks are not introduced in the middle of the identifier as it is read into the computer. Let the identifier on the card consist of a maximum of p characters, then the format of the identifier is given by the following:

Case	Format	Note
$7 \leq p \leq 12$	(A6, Ar)	r = p - 6
$1 \leq p \leq 6$	(Ap, A1)	One extra blank column on each card
No identifier	(2A1)	Two extra blank columns on each card

IV. Order of Cards

1. Parameter Card 1 (TITLE)
2. Parameter Card 2 (OPTIONS)
3. Parameter Card 3 (SPRAY VARIABLES)
4. Parameter Card 4 (SIZE CATEGORIES)
5. Parameter Card 5 (FORMAT, if needed)
6. First Data Card

. . . .

. . . .

. . . .

n. Last Data Card

OUTPUT DESCRIPTION AND FORMULAS

The following is a description of the output tables in the order which they are printed.

I. Control Cards

The variables in this section are the options from card (2) and the spray variables from card (3) (Figure 3).

Column Headings	Units	Descriptions
IFN	None	Option for spread factor equation.
IPRINT	None	Option which determines whether the section "Raw Data Tabulation" is printed and whether output is written on disk.
ISUMRY	None	Option which produces the statistical summaries with the heading "Results for Unit Cards."
IDUP	None	Option which determines treatment of cards with duplicate identifiers.
Density of Material	Grams/ milliliter	Density of material producing the spots. For all practical purposes this is the same as the specific gravity.
Photo Reduction Factor	None	Factor by which the linear dimension of the spray card image is reduced on film. If no photo reduction is used, this should have the value 1.0.
Area Scanned by Machine	Square Centimeters	Area that is scanned by spot counting machine. The area on the spray deposit card that is counted = (area scanned by machine) (photo reduction factor).
Spread Factor Equation	Micrometers	This equation relates the stain diameter and the drop diameter.

II. Size Category Data

The variables in this section are calculated from the size settings and the spread factor equation (Figure 3).

Column Heading	Unit	Description
Size Category	None	Number assigned to the various size settings.
Size Category	Micrometers	Upper limits of size group settings on spot counting machine. This is data from card (4).
Average Size	Micrometers	Let: U = Upper limit of size group. L = Lower limit of size group which is equal to upper limit of previous size group plus one micrometer. L = 0 for the first size group. Then $\text{average stain size} = \left(\frac{U^4 - L^4}{(4)\ (U - L)} \right)^{1/3}$
Stain of Upper Limit	Micrometers	Diameter of stains of spray deposit cards corresponding to the upper limit of the size setting. Stain = (size settings)* (photo reduction factor).
Stain of Lower Limit	Micrometers	Diameter of stains on spray deposit cards corresponding to the lower limit of the size setting. Stain = (size settings of the previous group + 1)* (photo reduction factor).

Column Heading	Unit	Descriptions
Average Stain	Micrometers	Diameter of stains on spray deposit cards corresponding to the average stain size of groups. Stain = (average size)* (photo reduction factor).
Drop of Upper Limit	Micrometers	Diameter of droplet that would make stains on spray deposit cards corresponding to stain of upper limit.
Drop of Lower Limit	Micrometers	Same as above except corresponding to stain on lower limit.
Average Drop	Micrometers	Same procedure for computing average stain, but using upper and lower drop sizes.
Mass	Grams	The mass of the average size droplet in this size category. Mass = density* (volume of droplet), where volume = $\pi D^3/6=0.5236D^3$, where D is the diameter of average size droplet = (average drop). Average drop is in centimeters, density is in grams/ml.

III. Raw Data Tabulation

This section is obtained by giving the control variable IPRINT a value of 0 or 2. It gives the information on the spot count data cards. The order of the data is that which occurs after any sorting. The values are those which occur after any treatment of duplicates. Sample output is shown in Figure 4.

Column Heading	Unit	Description
Identification 1 through M $\leq$ 5	None	The identifier for each card separated into a maximum of 5 (M).

Column Heading	Unit	Description
Size Categories	Counts	The number of spot counts recorded on the data cards for each size category. Negative counts are printed but are used as zeros in computations.

IV. Results For Unit Cards

This section is obtained by giving the control variable ISUMRY a value between 1 and 5. The first results are for the individual cards in the unit. Next, the overall results are given for all cards in the unit. Sample output is shown in Figures 5 and 6.

Column Heading	Unit	Description
Identification 1 through M $\leq$ 5	None	The identifier for each card separated into a maximum of 5 fields (M).
Mass Median Diameter	Micrometers	The mass median diameter of droplets for one card $MMD = DL_i + (DL_i)*(PCI - 50/PC_i)$ where, DL_i is the diameter of the droplet corresponding to the lower limit of size category i. PCI is the sum of the percent mass in each category, summed from the largest size category to and including category i. PC_i is the percent mass in category i. i is the number of size category such that, when

Column Heading	Unit	Description
		the percent mass is accumulated from the largest to the smallest size category, is the number of first size category that is greater than 50%. Mass is the total number of counts in each category times the mass of the average drop in the category as previously calculated.
Mass Mean	Micrometers	Mass mean diameter of the average droplet for a card is defined below by D: $$D = \frac{\sum_{i=1}^{n} C_i d_i^4}{\sum_{i=1}^{n} C_i d_i^3},$$ where, n = Maximum number of size categories, C_i = Counts in i^{th} category, and

Column Heading	Unit	Description
		d_i = is the average diameter for the droplet in the i^{th} size category.
Number Median Diameter	Micrometers	The number median diameter of droplets for this card.
		$NMD = DL_i + (DL_{i+1} = DL_i)^* (PNI - 50)/PN_i$
		where,
		DL_i is the diameter of the droplet corresponding to the lower limit of size category i.
		PN_i is the percent of drops in size category i.
		PNI is the sum of drops from largest size category to and including category i.
		i is the number of size category such that as the percent of drops is summed from the largest to the smallest size category, i

Column Heading	Unit	Description
		is the number of the first size category that is greater than 50%.
Number Mean Diameter	Micrometers	The number mean diameter of droplets for this card defined by, $\frac{\sum_{i=1}^{n} C_i AD_i}{\sum_{i=1}^{n} C_i}$ where, C_i = Counts in the i^{th} category, AD_i = Average diameter of drops in size category i.
Deposition Density, MG/M**2	Milligrams/ square meter	The total mass collected at this card divided by the area of the spray deposit card that was scanned. $MG/M^{**}2 = \frac{\sum_{i=1}^{n} C_i M_i}{FACT}$ where, i is the size category index n is maximum number of categories C_i is counts in i^{th} category

Column Heading	Unit	Description
		M_i is average mass of a droplet in the i^{th} category FACT = Area of spray deposit card that is scanned.
Deposition Density, DRP/CM**2	Counts/ square centimeter	The total number of drops collected at this card divided by the area of the spray deposit card that was scanned. $DRP/CM**2 = \frac{\sum_{i=1}^{n} C_i}{FACT}$
Recovery Rate ounces/Acre	Fluid ounces/Acre	The total volume collected at this card divided by the area of the spray deposit card that was scanned.
Recovery Rate gallon/Acre	U.S. gallons/ Acre	The total volume collected at this card divided by the area of the spray deposit card that was scanned.
Area Assigned	Square meter	Area that is assigned a card.
Mass Recovered	Grams	The total mass collected at this card for the preceding area.

V. Unit Summary

This section continues the section titled "Results for Unit Cards" and presents results for all cards in the unit by size category (Figures 5 and 6).

Column Heading	Unit	Description
Size Category	None	The size categories 1 through 16
Number of Counts Over Spray Area	Counts	For each size category the total number of counts for the unit is computed by, $NUM = \sum_{i=1}^{n} C_{ij} * A_j / FACT,$ where i is the size category. j is the card within the unit, N is the number cards in the unit. C_{ij} is the number of counts in the i^{th} category at the j^{th} card. FACT is the area of the spray deposit card that is scanned.
Mass Recovered Over Spray Area	Grams	Mass of material recovered for each size category for the unit. $Mass_i = NUM_i * M_i$ where, NUM_i is the number of counts for all cards in the unit in size category i.

Column Heading	Unit	Description
		(See Column Heading - Number of Counts Over Spray Area). M_i is the mass of average size droplet in size category i.
Cumulative Mass	Grams	Cumulative mass of preceding column summed from largest to smallest size category.
Percent Mass	Percent	Percent of total mass that was in this size category.
Cumulative Percent Mass	Percent	Cumulative percent of preceding column summed from largest to smallest size category.
Lower Limit Drop Size	Micrometers	Diameter of droplet that would make stains on spray deposit cards corresponding to the lower limit of the size category.

VI. Results For All Cards

This section is exactly like the section titled "Results for Unit Cards" except that results for all input data cards are summarized. This section is always present in the output (Figure 7).

PROGRAM NARRATIVE

The ASCAS Program consists of a main program, 4 subroutines and 1 function routine. The MAIN program drives the system and calls the appropriate subroutines specified by the parameters. Subroutine SPLIT identifies and separates the identification field into the maximum of 5 fields. LNKLST rearranges the order of the identifiers and sorts the data. This routine is used only if option ISØRT and/or IØRDER are non-zero. PAGER is called when the lines of print has filled a page

and generates titles to be printed on the top of each page. The Function ABC computes the predicted value of drop size from the stain size based on the spread factor relationships. Summary is a summary subroutine used to compute and aggregate individual spray card data. Listed below are the program names, lines of Fortran code, and storage used to compile the system.

Program name	Lines of code	Storage used for Code	Data
MAIN	293	1732	36,777
SUMMARY	108	473	415
PAGER	12	41	12
LNKLST	106	371	71
FUNCTION ABC	15	102	14
SPLIT	70	347	145

The program used 31K for compiling at a cost of $5.20 (FCCC). The test runs, with 200 spray cards, used 26K of computer storage, had a total time of 9.045 seconds and cost $2.53 using priority L at FCCC.

Production runs of 200-300 spray cards would range from $2.00 - $4.00 depending on the various options selected and the priority.

OPERATING PROCEDURES

I. Fort Collins Computer Center (FCCC)

A. Preparing data file - Batch Mode

@RUN,

@ASG,UP XYZ*DATA.

@DATA,IL XYZ*DATA.

Card 1 Parameter

Card 2 Parameter

Card 3 Parameter

Card 4 Parameter

Card 5 Parameter (if needed)

DATA CARDS

```
@END

@FIN

@@
```

The @ASG,UP statement assigns a new file to be made. The file name DATA with qualifier XYZ are examples.

The @DATA,IL will insert data into the new file and will provide a listing to be used for review prior to running.

B. Running the job - Batch Mode

```
@RUN,

@ASG,A XYZ*DATA.

@XQT MAG*ASCAS.ASCAS-XQT

@ADD XYZ*DATA.

@FIN

@@
```

If the option of IPRINT is a 2 or 3 specifying that the output is to be written on disk, then the following job stream would be used:

```
@RUN,

@ASG,UP XYZ*OUTPUT.

@ASG,A XYZ*DATA.

@USE 11., XYZ*OUTPUT.

@XQT MAG*ASCAS.ASCAS-XQT

@ADD XYZ*DATA.

@FIN

@@
```

The intent of this paper is not to instruct potential users how to run jobs on the FCCC but to provide operating instructions for one specific job. Please consult your computer science staff personnel if you are not familiar with the FCCC operating system.

II. University of California, Davis Computer Center

A. Preparing data file - Batch Mode

```
$ User

$ Password

$ Execute * Utility/Copier

$ Data

Copy (KIND = READER) to (KIND = DISK, TITLE = "FILE NAME",
     FILEKIND = DATA) List done.

Card 1 Parameter

Card 2 Parameter

Card 3 Parameter

Card 4 Parameter

Card 5 Parameter (if needed)

       DATA CARDS

$ END $

STOP

$ END JOB
```

B. Running the job - Batch Mode

```
$ USER

$ PASSWORD

$ RUN ASCAS

$ FILE  FILE 5 (KIND = DISK, TITLE = "FILENAME",
        FILETYPE = 7)

$ OPTION = AUTORM

$ END JØB
```

If the option on IPRINT is a 2 or 3 specifying that the output is to be written on disk, then the following job stream would be used:

```
$ USER

$ PASSWORD

$ RUN ASCAS

$ FILE  FILE 5 (KIND = DISK, TITLE - "FILENAME",
        FILETYPE = 7)

$ FILE  FILE II (KIND = DISK, TITLE = "OUTPUTFILE",

  MAXRECISE = 14, BLOCKSIZE = 420, AREASIZE = 450,
  AREAS = 1, SECURITY = 1Ø, FLEXIBLE = TRUE)

$ END JOB
```

C. Running the job - demand mode with wide carriage terminal

```
RUN ASCAS;%

FILE  FILE 5 (KIND = DISK, TITLE = "FILENAME", FILETYPE
      = 7)
```

REGION 4 -- BLOCK 1 -- TREES PAGE 1

VALID CARDS READ IN = 40

********** CONTROL CARDS **********

IFN = 1 IPRINT = 0 ISUMRY = 1 IDUP = 0 ISORT = 0 IORDER(I) = 1 2 3 0 0
DENSITY OF MATERIAL = 1.000 G/ML PHOTO REDUCTION FACTOR = 1.000 AREA SCANNED BY MACHINE = 16.5660 CM**2
DROP DIAM = (-3541+02) + (5500+00)*STAIN DIAM + (0000)*STAIN DIAM**2

********** SIZE CATEGORY DATA **********

SIZE CATEGORY	SIZE SETTING	AVG SIZE	STAIN OF UP LIMIT	STAIN OF LOW LIMIT	AVG STAIN	DROP OF UP LIMIT	DROP OF LOW LIMIT	AVG DROP	MASS(GM)
1	92.0	58.0	92.0	.0	58.0	15.2	0	9.6	4.589-10
2	195.0	149.8	195.0	93.0	149.8	71.8	15.7	49.1	6.202-08
3	298.0	250.5	298.0	196.0	250.5	128.5	72.4	103.0	5.720-07
4	400.0	351.9	400.0	299.0	351.9	184.6	129.0	158.4	2.083-06
5	499.0	451.8	499.0	401.0	451.8	239.0	185.1	213.2	5.077-06
6	599.0	551.0	599.0	500.0	551.0	294.0	239.6	267.7	1.005-05
7	712.0	657.6	712.0	600.0	657.6	356.2	294.6	326.4	1.820-05
8	796.0	755.3	796.0	713.0	755.3	402.4	356.7	380.0	2.874-05
9	895.0	847.0	895.0	797.0	847.0	456.8	402.9	430.5	4.177-05
10	1006.0	952.1	1006.0	896.0	952.1	517.9	457.4	488.3	6.095-05
11	1106.0	1057.3	1106.0	1007.0	1057.3	572.9	518.4	546.1	8.529-05
12	1198.0	1153.1	1198.0	1107.0	1153.1	623.5	573.4	598.8	1.124-04
13	1299.0	1249.7	1299.0	1199.0	1249.7	679.0	624.0	651.9	1.451-04
14	1393.0	1347.1	1393.0	1300.0	1347.1	730.7	679.6	705.5	1.839-04
15	1495.0	1445.1	1495.0	1394.0	1445.1	786.8	731.3	759.4	2.293-04
16	1706.0	1603.3	1706.0	1496.0	1603.3	902.9	787.4	846.5	3.176-04

Figure 3 - Sample output showing control cards and size category data.

********** RAW DATA TABULATION **********

IDENTIFICATION					SIZE CATEGORIES															
1	2	3	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	SUM
1	3	1			37.	17.	9.	2.	4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	69.
1	3	2			32.	16.	9.	1.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	61.
1	3	3			21.	6.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	29.
1	3	4			41.	29.	19.	10.	3.	5.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	108.
2	2	1			17.	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	21.
2	2	2			19.	7.	18.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	47.
2	2	3			11.	9.	4.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	26.
2	2	4			8.	1.	2.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	12.
3	3	1			17.	6.	2.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	26.
3	3	2			12.	12.	21.	14.	20.	3.	3.	1	0.	0.	0.	0.	0.	0.	0.	0.	86.
3	3	3			28.	16.	17	17.	6.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	86.
3	3	4			18.	7.	7.	5.	2.	0.	1.	0.	1	0.	0.	0.	0.	0.	0.	0.	41.
4	1	1			17.	5.	2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	24.
4	1	2			11.	7.	5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	23.
4	1	3			16.	3.	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	20.
4	1	4			31	15.	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	50.
5	2	1			18.	6.	7.	4.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	35.
5	2	2			20.	6.	14	9.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	52.
5	2	3			18.	16.	13.	2.	0.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	51.
5	2	4			9.	3.	15.	3.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	31.
6	2	1			32.	39.	10.	19.	15.	12.	7.	1.	1.	1.	0.	0.	0.	0.	0.	0.	137.
6	2	2			13.	7.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	20.
6	2	3			9.	6.	1	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	17.
6	2	4			29.	30.	23.	14	17.	10.	6.	0.	0.	0.	0.	0.	0.	0.	0.	0.	129.
7	1	1			25.	7.	8.	12	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	55.
7	1	2			14.	9.	4	14	4	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	47.
7	1	3			7.	8	7.	15.	11.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	48.
7	1	4			4	5.	3.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	14.

Figure 4 - Sample output of raw data tabulation

********** RESULTS FOR UNIT CARDS **********

IDENTIFICATION					DIAMETERS (MICROMETERS)				DEPOSITION DENSITY		RECOVERY RATE		AREA ASSIGNED	MASS RECOVERED
1	2	3	0	0	MASS MEDIAN	MASS MEAN	NUMBER MEDIAN	NUMBER MEAN	MG/M**2	DRP/CM**2	OZ/ACRE	GAL/ACRE	M**2	GRAMS
1	3	1			198.4	181.6	14.7	47.6	18.5	4.17	2.5	.02	1.00	.019
1	3	2			197.6	177.1	15.0	46.2	14.2	3.68	1.9	.02	1.00	.014
1	3	3			91.3	89.3	10.9	24.2	.9	1.75	.1	00	1.00	.001
1	3	4			250.4	231.7	41.1	71.0	70.7	6.52	9.7	.08	1.00	.071
OVERALL					220.3	214.1	17.8	54.2	26.1	4.03	3.6	03	4.00	.104

UNIT SUMMARY

SIZE CATEGORY	NUMBER OF COUNTS OVER SPRAY AREA	MASS RECOVERED OVER SPRAY AREA (GM)	CUMULATIVE MASS (GM)	PERCENT MASS (=)	CUMULATIVE PERCENT MASS (=)	LOWER LIMIT DROP SIZE (MICROMETERS)
1	79078.	.000	.104	03	100.00	.00
2	41048.	.003	.104	2.44	99.97	15.74
3	23542.	.013	.102	12.90	97.53	72.39
4	7847.	.016	088	15.66	84.62	129.04
5	6036.	.031	072	29.36	68.96	185.14
6	3018.	.030	041	29.07	39.60	239.59
7	604.	011	011	10.53	10.53	294.59
8	0.	.000	.000	.00	.00	356.74
9	0.	.000	.000	.00	.00	402.94
10	0.	.000	.000	.00	.00	457.39
11	0.	.000	.000	.00	.00	518.44
12	0.	.000	.000	.00	.00	573.44
13	0.	.000	.000	.00	.00	624.04
14	0.	.000	.000	.00	.00	679.59
15	0.	.000	.000	.00	.00	731.29
16	0.	.000	.000	.00	.00	787.39
TOTAL	161173.	.104				

Figure 5 - Sample output for unit cards and unit summaries (cluster level).

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********** RESULTS FOR UNIT CARDS **********

IDENTIFICATION					DIAMETERS (MICROMETERS)				DEPOSITION DENSITY		RECOVERY RATE		AREA ASSIGNED	MASS RECOVERED
1	2	3	0	0	MASS MEDIAN	MASS MEAN	NUMBER MEDIAN	NUMBER MEAN	MG/M**2	DRP/CM**2	OZ/ACRE	GAL/ACRE	M**2	GRAMS
3	3	1			136.6	129.3	12.0	31.6	2.2	1.57	.3	.00	1.00	.002
3	3	2			231.6	250.5	123.6	133.9	155.1	5.19	21.2	.17	1.00	.155
3	3	3			224.7	271.5	68.8	87.6	82.4	5.19	11.3	.09	1.00	.082
3	3	4			354.3	331.5	36.0	78.4	51.3	2.47	7.0	.05	1.00	.051
OVERALL					236.7	269.8	76.6	96.6	72.8	3.61	10.0	.08	4.00	.291

UNIT SUMMARY

SIZE CATEGORY	NUMBER OF COUNTS OVER SPRAY AREA	MASS RECOVERED OVER SPRAY AREA (GM)	CUMULATIVE MASS (GM)	PERCENT MASS (=)	CUMULATIVE PERCENT MASS (=)	LOWER LIMIT DROP SIZE (MICROMETERS)
1	45273.	.000	.291	01	100.00	.00
2	24749.	.002	291	53	99.99	15.74
3	28371.	.016	.289	5.58	99.47	72.39
4	22335.	.047	.273	15.98	93.89	129.04
5	16902.	.086	.227	29.48	77.90	185.14
6	1811.	.018	141	6.25	48.42	239.59
7	3018.	.055	.123	18.88	42.17	294.59
8	604.	.017	.068	5.96	23.29	356.74
9	1207.	.050	.050	17.33	17.33	402.94
10	0.	.000	.000	.00	.00	457.39
11	0.	.000	.000	.00	.00	518.44
12	0.	.000	.000	.00	.00	573.44
13	0.	.000	.000	.00	.00	624.04
14	0.	.000	.000	.00	.00	679.59
15	0.	.000	.000	.00	.00	731.29
16	0.	.000	.000	.00	.00	787.39
TOTAL	144271.	.291				

Figure 6 - Sample output for unit cards and unit summaries (cluster level).

********** RESULTS FOR ALL CARDS **********

	DIAMETERS (MICROMETERS)				DEPOSITION DENSITY		RECOVERY RATE		AREA ASSIGNED	MASS RECOVERED
	MASS MEDIAN	MASS MEAN	NUMBER MEDIAN	NUMBER MEAN	MG/M**2	DRP/CM**2	OZ/ACRE	GAL/ACRE	M**2	GRAMS
OVERALL	351.7	387.9	58.2	96.1	90.9	2.86	12.4	10	40.00	3.636

---------- TOTAL SUMMARY ----------

SIZE CATEGORY	NUMBER OF COUNTS OVER SPRAY AREA	MASS RECOVERED OVER SPRAY AREA (GM)	CUMULATIVE MASS (GM)	PERCENT MASS (=)	CUMULATIVE PERCENT MASS (=)	LOWER LIMIT DROP SIZE (MICROMETERS)
1	398406.	.000	3.636	.01	100.00	.00
2	231196.	.014	3.636	.39	99.99	15.74
3	194374.	.111	3.621	3.06	99.60	72.39
4	124351.	.259	3.510	7.12	96.54	129.04
5	88132.	.447	3.251	12.31	89.42	185.14
6	45877.	.461	2.804	12.68	77.11	239.59
7	31390.	.571	2.343	15.72	64.43	294.59
8	12073.	.347	1.771	9.54	48.72	356.74
9	8451.	.353	1.424	9.71	39.17	402.94
10	604.	.037	1.071	1.01	29.46	457.39
11	1811.	.154	1.034	4.25	28.45	518.44
12	4829.	.543	.880	14.93	24.20	573.44
13	604.	.088	.337	2.41	9.27	624.04
14	604.	.111	.249	3.05	6.86	679.59
15	604.	.138	.138	3.81	3.81	731.29
16	0.	.000	.000	.00	.00	787.39
TOTAL	1143306.	3.636				

@FIN

Figure 7 - Sample output for all cards.

ACKNOWLEDGEMENTS

The authors wish to thank the following individuals for their assistance on the project.

G. Sutton, Dugway Proving Grounds for providing the original version of the ASCAS program and for his assistance with the documentation and providing answers to numerous questions.

L. Whyte, USDA Forest Service, Forest Insect and Disease Management, Methods Application Group, Davis, CA 95616, for testing and evaluating the outputs and reviewing the drafts.

D. McCoy, Systems Specialist, R-5, for his assistance in the computer conversion to the Fort Collins Computer Center.